University of Cyprus

Department of Accounting and Finance

ESG IMPACT ON FINANCIAL INSTITUTIONS

A Comprehensive Study of Risk and Profitability in U.S. Banks

MASTER THESIS

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2024

University of Cyprus
Department of Accounting and Finance

ESG Impact on Financial Institutions: A Comprehensive Study of Risk and Profitability in U.S. Banks

Master Thesis in Finance

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Abstract

Purpose - This study aims to investigate the impact of Environmental, Social, and Governance (ESG) factors, both collectively and individually, on the profitability and riskiness of financial institutions. The metrics used for this analysis are Return on Assets (ROA) to measure profitability and z-score to gauge riskiness.

Design/Methodology/Approach - The dataset comprises 211 banks in the United States over the period 2017-2021, resulting in 1,055 observations. Data was primarily sourced from Refinitiv DataStream, Federal Reserve Economic Data (FRED), and the U.S. Bureau of Labor Statistics. A panel data regression analysis was employed.

Findings - The empirical results demonstrate a significant positive impact of ESG on the riskiness of U.S. banks. However, high ESG scores are also associated with increased profitability for these banks. This profitability rise occurs despite a negative correlation between ESG scores and bank risk-taking, indicating a complex dynamic that requires careful management by financial institutions.

Examining ESG disclosures individually, environmental, and social factors negatively affect the z-score but positively influence the ROA across all four related models. In contrast, corporate governance disclosure is statistically significant only in its positive effect on ROA.

The study's results suggest a trade-off between maximizing bank profitability and maintaining low-risk levels, highlighting the intricate role of ESG factors in banking.

Originality/Value - This study aims to catalyze ESG adoption in banking, aiding boards and stakeholders, and guiding policymakers for sustainability integration. It seeks to enhance academic and analyst comprehension of sustainability practices, support investor decisions, and promote societal benefits.

Keywords: ESG, Environmental disclosure, Social disclosure, Governance disclosure, Riskiness, Profitability, Bank Performance, Financial Industry, Financial Institutions, U.S. Banks

Date: June 14, 2024

ΤΜΗΜΑ ΛΟΓΙΣΤΙΚΗΣ

ΚΑΙ ΧΡΗΜΑΤΟΟΙΚΟΝΟΜΙΚΗΣ

30 Μαΐου 2024

Συντονιστή Μεταπτυχιακών Προγραμμάτων

Τμήματος Λογιστικής και Χρηματοοικονομικής

Β Ε Β Α Ι Ω Σ Η

Βεβαιούται ότι η μεταπτυχιακή φοιτήτρια Σταυρούλλα Μάμα (Αρ. Ταυτότητας 971239) ολοκλήρωσε με επιτυχία την προφορική υποστήριξη της διπλωματικής της μελέτης σε εξέταση που έλαβε χώραν ενώπιον διμελούς εξεταστικής επιτροπής, στις 30 Μαΐου 2024. Παρέδωσε την διπλωματική της μελέτη στις …………………………..

Η εξεταστική επιτροπή,

Σπύρος Μαρτζούκος
(Πρόεδρος, Σύμβουλος)

Στέλιος Μαρκουλής
(Σύμβουλος)

Acknowledgments

I would like to express my deepest gratitude to everyone who has supported me throughout the course of my research and master's thesis writing. This accomplishment would not have been possible without the guidance, assistance, and encouragement of many individuals.

First and foremost, I would like to thank my advisor, Dr. Stelios Markoulis, for his unwavering support, insightful feedback, and continuous encouragement. His expertise and guidance were invaluable in shaping my research and ensuring the successful completion of this thesis.

I am also immensely grateful to my thesis committee member and supervisor, Dr. Spiridon Martzoukos, for his constructive criticism, and valuable suggestions, and for taking the time to review my work.

Special thanks to Marios Kyriakou of the Administrative Team of the Faculty of Economics and Management at the University of Cyprus, who helped me with the data gathering and data sources. Without his assistance, this thesis could not have been completed.

To my family and friends, thank you for your endless love, patience, and understanding. Your constant encouragement kept me motivated and focused during the challenging times. A special note of appreciation goes to my parents, Christodoulos Damianou and Soteria Damianou, for their unconditional support and belief in my abilities.

Thank you all for being a part of this journey.

Sincerely,

Stavroulla Mama

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1. Introduction

Environmental protection is a shared responsibility that extends to every sector of the economy. This responsibility has led many companies to implement Environmental, Social, and Governance (ESG) practices aimed at reducing their environmental footprint and enhancing their overall societal impact. The banking sector is no exception, driven by socially responsible investors who consider ESG factors alongside traditional financial metrics. These investors seek to allocate their capital to banks that not only perform well financially but also contribute positively to the world.

ESG practices encompass a wide range of initiatives. The Environmental criterion examines how a business manages its impact on the natural environment, addressing issues such as climate change, waste and pollution, resource depletion, greenhouse gas emissions, and deforestation. The Social criterion evaluates how a company treats people, focusing on aspects such as working conditions, community engagement, conflict resolution, health and safety, employee relations, and diversity. Lastly, the Governance criterion assesses how a corporation is governed, emphasizing executive compensation, corruption and bribery, political donations and lobbying, board diversity and structure, and tax strategy.

The banking sector in the United States can be considered the cornerstone of the nation's financial infrastructure, playing a pivotal role in facilitating economic growth, capital allocation, and wealth management. Distinguished by a diverse landscape of institutions ranging from large multinational banks to community-based credit unions, the U.S. banking sector supports a broad spectrum of consumers, businesses, and government entities. Throughout the history of the country's economic development, the U.S. banking system can be seen as a pivotal agent. It operates within a dynamic regulatory environment shaped by federal agencies such as the Federal Reserve, the Office of the Comptroller of the Currency, and the Federal Deposit Insurance Corporation. Innovation and technological advancements continually reshape the U.S. banking sector, advancing digital transformation, with enhanced customer experiences, and evolved risk management practices. Although, amidst ongoing challenges and opportunities, the U.S. banking sector remains a vital driver of financial stability and prosperity, configured to adapt to the proliferation of the evolving market dynamics and societal expectations.

Banks are inherently prone to risk-taking due to their high leverage, limited market discipline (reflecting deposit insurance and too-big-to-fail guarantees), and the potential to increase the riskiness of their assets rapidly and opaquely (Di Tommaso and Thornton, 2020). The Global Financial Crisis (GFC) accentuated the critical importance of managing and measuring bank risks. Common risk measures include Value-at-Risk (VaR), Expected Shortfall (ES), and the Capital Asset Pricing Model (CAPM). For non-listed banks, risk can be estimated using accounting data, from mainstream measurements, including the ratio of Non-Performing Loans to Total Assets, and the z-score.

Despite the growing focus on sustainability, the discussion can inadvertently overlook its potential to boost organizational performance. The resource-based view of a firm suggests that companies can achieve higher profitability by openly disclosing both their financial and non-financial resources. Such transparency allows firms to develop distinctive capabilities and competencies, which are crucial for securing and sustaining a competitive edge (Buallay, 2019). Considering ESG factors can now be seen as an essential strategy for firms to not only improve their operational efficiency but also to strengthen their market positioning by leveraging these distinctive resources.

This study explores the impact of ESG factors on bank risk levels, both collectively and individually, by using the z-score measurement as the main risk indicator, building upon previous research by Li, Tripe, and Malone (2017) and others. Moreover, it aims to investigate the gap in ongoing discussions about sustainability's potential to enhance organizational performance. Specifically, the study investigates how the integration of ESG considerations can cultivate capabilities that contribute to improved financial performance and stability within the banking sector, measured through Return on Assets (ROA). To conduct this analysis, a dataset comprising 211 banks in the United States from 2017 to 2021, totaling 1,055 observations, is utilized. By employing panel data regression techniques, the study explores the implications ESG practices have on the financial performance metrics of these institutions.

The anticipated outcomes of this study hold significant potential for informing various aspects of banking operations and strategic decision-making. Firstly, the insights generated are expected to offer valuable guidance for enhancing risk management strategies within banks by examining the relationship between ESG factors and riskiness. Secondly, the findings are poised to assist banks in aligning their practices with stakeholders' expectations, helping them meet the growing emphasis on corporate social responsibility and sustainability. Finally, by analyzing how the integration of ESG factors affects profitability and risk, the research can provide insights into how banks can leverage sustainable practices to strengthen their market standing and differentiate themselves from competitors. Overall, these anticipated outcomes underscore the potential of ESG integration to drive positive change within the banking sector, contributing to both financial performance and broader stakeholder value.

The remainder of this paper is organized as follows: Section 2 reviews the relevant literature and hypotheses development. Section 3 describes the methodology, sample selection, variables used, and model validation tests. Section 4 reports the empirical results, while Section 5 presents additional analyses and robustness checks. Finally, Section 6 concludes with a summary of the findings, the limitations of the study, and recommendations for future research.

2. Literature Review and Hypotheses Development

ESG factors have evolved into critical metrics within the financial landscape, reflecting a growing recognition of the broader impacts that companies have beyond traditional financial metrics. As such, they have garnered significant attention in scholarly and practical discussions surrounding the performance of financial institutions. Scholars and industry experts alike have delved into understanding the nuanced relationship between these ESG factors and financial performance, aiming to decipher their impact on risk management, profitability, and overall sustainability.

However, the body of literature on this subject is characterized by a spectrum of findings, ranging from studies that highlight the positive influence of robust ESG practices on financial outcomes to those that uncover potential complexities and challenges associated with integrating ESG considerations into financial decision-making processes. This diversity of findings underscores the multifaceted nature of the relationship between ESG factors and financial performance, fueling an ongoing discourse within both academic circles and the broader financial industry.

2.1 Impact of ESG on Risk

The impact of ESG factors on risk within financial institutions has been a subject of considerable research interest. Bouslah, Kryzanowski, and M'Zali (2018) offer insights into this relationship, demonstrating that ESG factors, particularly social performance, exhibit a negative correlation with various risk measures, including idiosyncratic and systematic risks. Their findings emphasize the role of social performance in reducing volatility and idiosyncratic risk, particularly evident during financial crises. Moreover, they highlight the asymmetric nature of this relationship, where strengths in social performance have a more pronounced effect than concerns. This underscores the dynamic interplay between ESG factors and market conditions, shaping their impact on risk within financial institutions.

Bae et al. (2018) further explore the role of corporate social responsibility (CSR), a key component of ESG, in mitigating the costs associated with high leverage. Their findings align with those of Bouslah, Kryzanowski, and M'Zali (2018), as they reveal that CSR activities help companies maintain their market share even when heavily leveraged. CSR initiatives assist in retaining customers and protecting against competitive threats, reinforcing the notion that robust social performance can play a crucial role in reducing financial risks. Together, these studies highlight the significant influence of social performance within ESG on enhancing stability and mitigating risks in financial institutions.

Further corroborating these observations, Chiaramonte et al. (2021) provide evidence that banks with higher ESG scores are less susceptible to insolvency during periods of financial distress. Their study aligns with the moral capital theory, suggesting that ethical practices inherent in ESG engagement contribute to more prudent banking behaviors and foster stable relationships within the financial community. This, in turn, leads to a reduction in the overall risk profile of these institutions, highlighting the broader societal benefits of integrating ESG considerations into financial decision-making processes.

Echoing these sentiments, Di Tommaso and Thornton (2020) assert that high ESG scores are associated with reduced risk-taking behavior within financial institutions. Their study lends support to the stakeholder view of ESG, indicating that robust ESG practices, spanning governance, environmental, and social dimensions, serve to mitigate risk. Together, these studies underscore the pivotal role of ESG factors in shaping risk dynamics within financial institutions, with implications for both internal risk management strategies and broader systemic stability.

Drawing from the preceding discussions, the ensuing hypothesis is formulated for examination:

> Hypothesis 1: *ESG parameters, both collectively and individually, positively affect the riskiness of a U.S. bank.*

2.2 Impact of ESG on Profitability

Buallay (2019) investigates the relationship between ESG practices and financial performance, specifically focusing on return on assets (ROA). The study finds a significant positive impact of ESG on ROA, return on equity (ROE), and Tobin's Q (TQ), suggesting that ESG practices enhance operational, financial, and market performance. This is particularly evident in environmental disclosures, which are positively associated with ROE and TQ, indicating that stakeholders value environmental practices and incorporate them into investment decisions.

However, Buallay (2019) also notes a negative relationship between corporate social responsibility (CSR) disclosures and performance indicators, implying that some social policies may incur costs that outweigh the benefits. This nuance suggests that while ESG factors generally enhance profitability, the individual components may have differing impacts.

El Khoury et al. (2021) support this complexity by finding a negative relationship between ESG disclosure and profitability, particularly in large firms where banks may use social disclosures to mask poor performance. This highlights the varied impacts of ESG practices depending on firm size and specific ESG activities.

Additionally, Birindelli et al. (2018) demonstrate that larger and more profitable banks tend to have better sustainability performance. Their findings indicate that bank size and economic performance (ROE) positively and significantly impact ESG performance, underscoring the role of institutional size and profitability in achieving superior ESG outcomes. Also, other studies present contrasting results to those of Buallay (2019) and El Khoury et al. (2021) concerning the impact of the social pillar on financial performance. The findings of Paltrinieri et al. (2020), indicate a general positive correlation between the aggregated ESG score and financial performance, with a notable emphasis on the social pillar. This strong influence of the social dimension can be attributed to the priorities of Islamic finance institutions, which place significant importance on factors such as employment quality, health and safety, training, diversity, and human rights.

Despite these mixed findings, the overall positive association between ESG and financial performance, particularly in environmental practices, leads to the hypothesis that:

> Hypothesis 2: *ESG parameters, both collectively and individually, positively affect the profitability of a U.S. bank.*

The literature indicates a nuanced relationship between ESG factors and the financial performance of banks. While ESG practices generally reduce risk and potentially enhance profitability, the specific impact of each ESG component can vary. This study aims to further investigate these relationships in the context of U.S. banks from 2017 to 2021, contributing to a more comprehensive understanding of ESG's role in the financial sector.

3. Data and Methodology

3.1 Sample Selection and Data Sources

This study concentrates on U.S. banks and utilizes a comprehensive dataset consisting of three main components:

1) ESG data,
2) Bank-specific (CAMELS) data, and
3) Country-specific data.

The ESG data are sourced from Refinitiv DataStream, same as El Khoury, Nasrallah, & Alareeni (2021). Initially, the dataset included 878 banks worldwide. The first step in the data preparation process involved filtering this dataset to retain only U.S. banks, reducing the sample to 344 banks. The original sample period spanned from 2002 to 2022. However, due to the unavailability of ESG scores in certain years —attributable to the nascent and sometimes reluctant nature of ESG disclosures— the study period was adjusted to a more recent five-year window, from 2017 to 2021.

Data required to calculate the dependent variables and bank-specific CAMELS indicators were primarily obtained from Refinitiv DataStream, as well. Additional data were sourced from Wharton Research Data Services (WRDS), particularly from Compustat (Banks) and S&P Capital IQ and supplemented by individual banks' annual reports available from the U.S. Securities and Exchange Commission (SEC). Data were matched using the Ticker or ISIN code. Due to missing values necessary for calculating the CAMELS indicators, banks with incomplete data were excluded from the analysis, resulting in a final sample of 211 U.S. banks, corresponding to 1055 observations.

Country-specific data, such as the GDP growth rate and inflation, were sourced from Federal Reserve Economic Data (FRED) and the U.S. Bureau of Statistics, respectively. For inflation, the Consumer Price Index (CPI) was used, with the December price chosen for each year rather than the average annual price.

Table 1 provides an overview of the variables employed in the model, their data sources, and their hypothesized relationships with the dependent variable. A detailed explanation of the construction of these variables will follow.

3.2 Dependent Variables

To validate the first and second hypotheses, data on Return on Assets (ROA), Equity, and Assets were retrieved. Specifically, for the second hypothesis, only ROA was required (Buallay, 2019; El Khoury, Nasrallah, & Alareeni, 2021). This data was primarily sourced from Refinitiv Datastream and supplemented, where necessary, with data from other aforementioned sources.

For the first hypothesis, the analysis began with the computation of the z-score for U.S. banks, following the methodology of Li et al. (2017), Chiaramonte, Croci, and Poli (2015), and Bouslah, Kryzanowski, and M'Zali (2018). The z-score measures the risk-taking behavior of each bank and is mathematically represented by the following equation:

$$z - score = \frac{ROA + \left(\frac{Equity}{Asset}\right)}{\sigma_{(ROA)}}$$

Consequently, the z-score establishes a connection between a bank's capitalization, its return (ROA), and risk (volatility of returns). A higher z-score indicates a lower risk of insolvency, suggesting that a bank has a strong capital base relative to its risk and earnings volatility, providing a substantial buffer against potential losses.

Li et al. (2017) delineated in their study that the equation can be dissected into two segments: the ROA component, denoted as $\frac{ROA}{\sigma_{(ROA)}}$, and the leverage component, expressed as $\frac{\left(\frac{Equity}{Asset}\right)}{\sigma_{(ROA)}}$. The ROA component accounts for both the magnitude and variability of returns, serving as an indicator of a bank's portfolio risk. Conversely, the leverage component reflects the bank's capital coverage capacity relative to a given level of risk, thus measuring the bank's leverage risk. Both components can be employed as measures of insolvency risk. For the purpose of this study, the standard deviation of the ROA is computed over the five previous years up to the fiscal year-end date of each firm-year observation, following the methodology of Bouslah, Kryzanowski, and M'Zali (2018).

Table 1: Variable Definitions, Data Sources, and Expected Relationships

This table presents definitions for the variables incorporated in the model, along with their respective data sources, and outlines their hypothesized relationships with the dependent variables. All variables listed are continuous in nature. Explanatory variables include the ESG Score and its constituent pillars, as well as country-specific and bank-specific data. Bank-specific data are derived from the CAMELS model, which covers Capital Adequacy, Asset Quality, Management Capability, Earnings, Liquidity, and Sensitivity.

Variable Name	Definition	Source	Profitability Exp. Sign	Riskiness Exp. Sign
Dependent Variable:				
Riskiness: Z_Score	**z-score**: A measure of risk-taking for individual banks derived from accounting data. The equation can be decomposed into two components: the ROA component and the leverage component, calculated as: $$z-score = \frac{ROA + \frac{Equity}{Assets}}{\sigma_{ROA}}$$ The standard deviation of the ROA is calculated based on the five preceding years up to the fiscal year-end date of each firm-year observation. A higher z-score indicates a lower risk of insolvency. It suggests that a bank has a strong capital base relative to its risk and earnings volatility, thus providing a substantial buffer against potential losses.	Refinitiv DataStream, U.S. Securities and Exchange Commission (SEC), Wharton Research Data Services (WRDS)		
Profitability: ROA	**Return on Assets (ROA)**: A financial metric that assesses a bank's profitability by measuring the efficiency with which it utilizes its assets to generate profits, calculated as: ROA (%) = Net Profit (or Loss) / Total Assets			
Explanatory Variables:				
ESG_Score	**ESG Score** (%): An overall bank score derived from self-reported information in the environmental, social, and corporate governance pillars. ESG Scores are expressed as percentages, ranging from 0 to 100%.	Refinitiv DataStream	+/-	+/-
ENV_Score	**Environment Pillar Score** (%): The weighted average relative rating of a bank based on reported environmental information, encompassing three environmental category scores: Resource Use, Emissions, and Innovation.		+/-	+/-
SOC_Score	**Social Pillar Score** (%): The weighted average relative rating of a bank derived from reported social information, including four social category scores: Workforce, Human Rights, Community, and Product Responsibility.		+/-	+/-
GOV_Score	**Governance Pillar Score** (%): The weighted average relative rating of a bank based on reported governance information, comprising three governance category scores: Management, Shareholder Relations, and CSR Strategy.		+/-	+/-

Bank-Specific Variables (CAMELS):				
CET1R	**Capital Adequacy:** The minimum amount of capital reserves required by banks to mitigate risks associated with their assets, such as NPLs. CET1R (%) = Common Equity Tier I/Risk Weighted Assets	Refinitiv DataStream, U.S. Securities and Exchange Commission (SEC), Wharton Research Data Services (WRDS)	+	-
NPL_GL	**Asset Quality:** Indicates the overall quality of a bank's assets. For instance, if a bank extends loans to high-risk borrowers, the value of its assets may depreciate rapidly**.** Non-Performing Loans to Gross Loans (%) = Non-Performing Loans (NPLs) / Gross Loans		-	+
Cost_IncR	**Management Capability:** Assesses the proficiency of a bank's management team in identifying and addressing financial stress. It encompasses the bank's ability to monitor, track, and control various risks, including credit, market, and liquidity risks. Cost to Income Ratio (%) = Operating Expenses / Operating Income		-	+
NIM	**Earnings:** Evaluate a bank's long-term sustainability and competitiveness, reflecting its capacity to expand and enhance capital. Net Interest Margin (%) = Net Interest Income / (Average Interest-Earnings Assets)		+	+/-
NL_TCD	**Liquidity:** Measures a bank's ability to maintain sufficient cash reserves to prevent a bank run and ensure financial stability. Net Loans to Total Customer Deposits (%) = Net Loans / Total Customer Deposits		+	+
NonIntInc_TI	**Sensitivity:** Indicates a bank's vulnerability to market risks, including fluctuations in interest rates, exchange rates, and commodity prices. Sensitivity is often quantified using Beta, which measures the extent to which earnings are influenced by these factors. Non-Interest Income relative to Total Income (%) = Income generated from Non-Interest Activities / Total Income		+	+/-
Country-Specific Variables:				
GDP	**Annual Gross Domestic Product (GDP) Growth Rate**: A key indicator to evaluate the rate of economic growth or decline in a country. $GDP\ Growth\ Rate\ (\%) = \left(\frac{GDP_t - GDP_{t-1}}{GDP_{t-1}}\right)$	Federal Reserve Economic Data (FRED)	+	+/-
Inflation	**Consumer Price Index (CPI)** (%): Measures the average change over time in the prices paid by urban consumers for a standard basket of consumer goods and services, serving as a primary indicator of inflation. This measurement uses data from the CPI of each December.	U.S. Bureau of Labor Statistics	-	+/-

In choosing the z-score over other risk measures, the decision was based on its comprehensive ability to capture both individual bank risk and insolvency risk, unlike traditional measures such as Value at Risk (VaR) and Expected Shortfall (ES), which focus primarily on the risk associated with individual institutions and fail to account for systemic risk adequately (Li et al., 2017). Alternative measures like Conditional Value-at-Risk (ΔCoVaR), Marginal Expected Shortfall (MES), Systemic Expected Shortfall (SES), Systemic Risk Indices (SRISK), and leave-one-out (LOO) approaches have been proposed to assess the systemic importance of banks, these methods still lack the integration of capital adequacy, return, and risk volatility that the z-score provides. The Z-score's dual consideration of a bank's capitalization and earnings volatility makes it a more robust and holistic measure for evaluating the riskiness and profitability of U.S. banks, offering a significant buffer against potential losses and a clearer indicator of insolvency risk.

3.3 Independent Variables

To investigate the hypotheses that ESG performance positively affects the riskiness and profitability of U.S. banks, a comprehensive set of independent variables was employed, encompassing ESG performance data, bank-specific CAMELS data, and country-specific macroeconomic data.

ESG Performance Data

The ESG performance data, both collectively and individually, were sourced from Refinitiv's ESG Score. This comprehensive company assessment is derived from self-reported data across the Environmental, Social, and Corporate Governance pillars (Buallay, 2019; Paltrinieri et al., 2020; El Khoury et al., 2021; Birindelli et al., 2018; Di Tommaso & Thornton, 2020; Chiaramonte et al., 2021). The ESG Scores are expressed as percentages, ranging from 0 to 100%(Refinitiv® ESG Scores, retrieved April 4, 2024, from https://solutions.refinitiv.com/try-refinitiv-esg-data). Each pillar consists of specific subcategories that provide a detailed evaluation of a company's performance in these areas.

- **Environment Pillar Score** (ENV_Score): Reflects the weighted average rating of a company's environmental practices. It includes:
  - ✓ Resource Use: Measures the efficiency in using materials, energy, and water in production processes and the efforts to minimize environmental impact.
  - ✓ Emissions: Assesses the company's management and reduction of greenhouse gas emissions, waste, and pollutants.
  - ✓ Innovation: Evaluates the development of eco-friendly products and services, and the integration of environmental considerations into product design and production processes.

- **Social Pillar Score** (SOC_Score): Gauges social performance based on criteria such as:
  - ✓ Workforce: Assesses employee satisfaction, diversity, training, health, and safety practices.
  - ✓ Human Rights: Measures the company's policies and practices regarding the protection of human rights within its operations and supply chain.
  - ✓ Community: Evaluate the impact of the company's activities on the local communities, including community engagement and development projects.
  - ✓ Product Responsibility: Looks at the company's commitment to ensuring the safety, quality, and accessibility of its products and services.
- **Governance Pillar Score** (GOV_Score): Evaluates governance practices, including:
  - ✓ Management: Reviews the structure, diversity, and effectiveness of the company's board and executive team.
  - ✓ Shareholder Relations: Assesses the company's practices in engaging with and protecting the rights of shareholders.
  - ✓ CSR Strategy: Examines the company's approach to Corporate Social Responsibility (CSR), including policies, programs, and performance in integrating CSR into its business strategy.

Bank-Specific CAMELS Data

For bank-specific data, the CAMELS model was instrumental. The CAMELS model is renowned for its effectiveness, efficiency, and precision in assessing banking performance and encompasses six critical areas: Capital adequacy, Asset quality, Management, Earning, Liquidity, and Sensitivity (Rostami, 2015). The following key ratios were selected from each category to investigate their impact on bank riskiness and profitability, following the approach of Chiaramonte, Croci, and Poli (2015):

- **CET1 Ratio** (CET1R): This ratio measures a bank's core equity capital compared with its total risk-weighted assets, reflecting its capital adequacy.
- **Non-Performing Loans to Gross Loans** (NPL_GL): This ratio assesses asset quality by indicating the proportion of loans that are in default or close to being in default.
- **Cost to Income Ratio** (Cost_IncR): This ratio evaluates management efficiency by measuring the operating costs as a percentage of operating income.
- **Net Interest Margin** (NIM): This ratio measures earning efficiency by indicating the difference between the interest income generated and the amount of interest paid out to lenders, relative to the amount of their (banks') interest-earning assets.
- **Net Loans to Total Customer Deposits** (NL_TCD): This ratio assesses liquidity by showing the proportion of customer deposits that are used to fund loans.
- **Non-Interest Income to Total Income** (NonIntInc_TI): This ratio measures the sensitivity and diversification of income sources by indicating the proportion of income that comes from non-interest sources.

These CAMELS indicators were selected due to their critical importance in evaluating different dimensions of bank performance, which are essential for understanding how ESG performance influences bank risk and profitability.

Country-Specific Macroeconomic Data

The study also integrated country-specific data, specifically the Gross Domestic Product (GDP) Growth Rate and Inflation. Inflation was measured using the Consumer Price Index (CPI), which reflects the changes over time in the prices paid by urban consumers for a standard basket of goods and services, with December data utilized for each year. GDP Growth Rate and Inflation are crucial metrics monitored by policymakers to gauge prevailing economic conditions and formulate informed economic policies.

The inclusion of these macroeconomic control variables is essential for capturing the broader economic environment in which banks operate. However, it introduces potential endogeneity issues, such as correlated variables, reverse causality, and simultaneity, as highlighted by Buallay (2019). To address these concerns, validity tests will be conducted to ensure the robustness of the results.

By combining ESG performance data, CAMELS indicators, and macroeconomic variables, this study aims to provide a comprehensive analysis of the factors influencing the riskiness and profitability of U.S. banks, thereby validating the proposed hypotheses.

3.4 Methodology

A panel data regression analysis was conducted on a dataset comprising 211 U.S. banks over a 5-year period (2017-2021), resulting in 1055 observations. This analysis aimed to assess the impact of each ESG parameter on the riskiness (z-score) and profitability (ROA) of U.S. banks while controlling for additional factors. The formulated models are as follows:

Riskiness (z-score):

$$Z\_Score_{it} = \beta_0 + \beta_1 ESG\ parameter_{it} + \beta_2 CET1R_{it} + \beta_3 NPL\_GL_{it} + \beta_4 Cost\_IncR_{it} + \beta_5 NIM_{it} + \beta_6 NL\_TCD_{it} + \beta_7 NonIntInc\_TI_{it} + \beta_8 GDP_{it} + \beta_9 Inflation_{it} + u_{it}$$

Profitability (ROA):

$$ROA_{it} = \beta'_0 + \beta'_1 ESG\ parameter_{it} + \beta'_2 CET1R_{it} + \beta'_3 NPL\_GL_{it} + \beta'_4 Cost\_IncR_{it} + \beta'_5 NIM_{it} + \beta'_6 NL\_TCD_{it} + \beta'_7 NonIntInc\_TI_{it} + \beta'_8 GDP_{it} + \beta'_9 Inflation_{it} + u'_{it}$$

Where:

- β_0 is the constant.
- Z_Score_{it} and ROA_{it} are the dependent variables for bank *i* at time t.
- $ESG\ parameter_{it}$ is the explanatory parameter for ESG, Environmental (ENV), Social (SOC), and Governance (GOV) Scores, for bank *i* at time t, affecting the dependent variables.
- $CET1R_{it},\ NPL\_GL_{it},\ Cost\_IncR_{it},\ NIM_{it},\ NL\_TCD_{it},\ and\ NonIntInc\_TI_{it}$, are the bank-specific variables, for bank *i* at time t, affecting the dependent variables.
- $GDP_{it}\ and\ Inflation_{it}$, are the country-specific variables, for bank *i* at time t, affecting the dependent variables.
- u_{it} is the error term.

Due to the high correlation among the ESG parameters, the models were subdivided into eight models to measure the relationship between each ESG reporting (ESG, ENV, SOC, GOV) and the bank's riskiness and profitability. Consequently, four models were run with the dependent variable being the bank's riskiness, measured by the z-score, and four models with the dependent variable being the bank's profitability, measured by ROA.

3.5 Model Validation

Consistent with Buallay's (2019) methodology, validation tests were executed to ensure the appropriateness of the statistical model utilized in this study. These tests, encompassing Normality, Collinearity, Stationarity, Autocorrelation, and Heteroscedasticity, serve to pinpoint potential issues or breaches of underlying assumptions, thereby bolstering the reliability and robustness of the analysis outcomes. The results of these tests are presented in Appendix 1 in the appendices. An analysis of these results follows.

A linear regression model was employed to scrutinize the relationship between sustainability reporting and both riskiness and performance.

Normality Test:

The normality of residuals was evaluated using both the Shapiro-Wilk parametric and Kolmogorov-Smirnov nonparametric tests across all eight panel data regression models. This assessment encompassed the dependent variables, z-score, and ROA, as well as all independent variables, including ESG scores, bank-specific, and country-specific variables. The null hypothesis of these tests assumes that the population follows a normal distribution, with a significance threshold set at 1%. Results indicated that for each model, the p-values for both the Shapiro-Wilk and Kolmogorov-Smirnov tests were significantly below this threshold (p < 0.01), nearly approaching zero. This suggests rejection of the null hypothesis of normality for all variables in each model. Hence, it can be inferred that the residuals are not normally distributed, consistent with Buallay's (2019) findings. This observation implies a violation of the normality assumption. Consequently, it may be advisable to employ robust standard errors or alternative estimation techniques to accommodate the non-normality in the residuals. However, it's important to note that the non-normal distribution of data might not substantially affect the credibility of the study, as linear regression typically demonstrates robustness to violations of normality assumptions, particularly with a considerable sample size.

Stationarity Test:

The stationarity of the data was evaluated using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests across all eight panel data regression models. Both the dependent and independent variables underwent testing for stationarity. The null hypothesis of these tests asserts the presence of a unit root, indicating non-stationarity, with a significance threshold set at 1%. Results indicated that both the ADF and PP tests produced statistically significant outcomes below this threshold ($p < 0.01$), indicating that the time series data spanning from 2017 to 2021 exhibited stationarity. This stationarity of the data is pivotal as it ensures the reliability of regression results, guarding against spurious findings and laying a firm groundwork for subsequent econometric analysis.

Collinearity Test:

Multicollinearity among the independent variables was examined using the Variance Inflation Factor (VIF) across all eight panel data regression models. The results present VIF values for all explanatory variables. Typically, in many studies such as Buallay (2019), VIF values exceeding 10 indicate high multicollinearity. While some studies adopt a stricter threshold of 5, others use a threshold of 15. For this study, a VIF threshold of 15 was employed. In all models, the VIF values for all variables, except Cost to Income Ratio (Cost_IncR), Net Interest Margin (NIM), and Net Loans to Total Customer Deposits (NL_TCD), were below this threshold, suggesting an acceptable level of multicollinearity. However, for these three variables (Cost_IncR, NIM, and NL_TCD), the VIF values were notably high (above 21), indicating a significant multicollinearity issue. Nevertheless, it was decided not to exclude any of these three CAMELS variables due to their importance as financial indicators.

Autocorrelation Test:

The Durbin-Watson (D-W) test was utilized to detect potential autocorrelation within the residuals of the study models. Autocorrelation arises when errors in a regression model are correlated, thereby violating the assumption of independence. Typically, D-W values close to 2 indicate no autocorrelation, while values approaching 0 signify positive autocorrelation. The results for the dependent variables z-score and ROA revealed significant deviations from the ideal value of 2. Specifically, the z-score models exhibited a D-W statistic of 0.4360, and the ROA models displayed a statistic of 0.1551. These findings indicate a strong presence of positive autocorrelation in the residuals across all models, suggesting a violation of the no-autocorrelation assumption. This violation could potentially affect the efficiency of the regression estimates.

Heteroscedasticity Test:

The presence of heteroscedasticity in the regression models, a critical assumption for regression analysis, was assessed using the Breusch-Pagan test. This test determines whether the variance of the errors in a regression model is dependent on the values of the independent variables, thus violating the assumption of homoscedasticity. The results indicated that the Lagrange multiplier statistic for all eight models ranged between 19.5798 and 45.6419, with p-values from nearly 0.0000 to 0.0207. The f-values for all eight models ranged from 2.1957 to 5.2504, with p-values from nearly 0.0000 to 0.0203. Since these p-values are well below the significance threshold of 0.05, we reject the null hypothesis of homoscedasticity. This indicates the presence of heteroscedasticity in the residuals of all models, suggesting that the variance of the errors is not constant. This variability could potentially affect the efficiency and consistency of the regression estimates.

4. Empirical Results

Following the validation tests for the model, robust standard errors were employed prior to executing any regression models to address heteroscedasticity concerns. Additionally, all variables, apart from the ESG explanatory variables, were winsorized at the 1st and 99th percentiles to mitigate the influence of outliers on the results.

This study can only assume a correlation between error and independent variables of the study sample. The Hausman Test confirmed this where a null hypothesis assumes that there is no systematic difference between the coefficients estimated by the Fixed-Effects (FE) model and the Random-Effects (RE) model. The Hausman test statistic is reported in Appendix 2 as extremely close to zero in all eight models and the p-value associated with the Hausman test statistic in all eight models is reported as 1. With a p-value of 1, there is strong evidence to accept the null hypothesis that the coefficients are consistent between the two models, and it is, therefore, preferable to use the RE approach, same as Buallay (2019).

4.1 Descriptive Statistics

This study conducted a comprehensive analysis of various explanatory variables, including ESG factors, and bank-specific and country-specific variables. Table 2 presents the descriptive statistics for both dependent and independent variables, encompassing measures such as mean, median, standard deviation, minimum and maximum values, and the first and third quartiles.

An important observation from Table 2 is that the mean values exceed the median values, indicating positive skewness in the distribution. Despite the winsorization process, several high values are pulling the mean upward, resulting in a mean greater than the median. This indicates that while the majority of data points are relatively low, some exceptionally high values could significantly impact the analysis.

Table 2: Descriptive Statistics

This table presents descriptive statistics, including mean, median, standard deviation, minimum and maximum values, as well as the 1st and 3rd quartiles (Q1 & Q3), for all variables examined in the study. The dataset comprises 1055 bank-year observations spanning the period from 2017 to 2021. Notably, dependent variables (Z_Score, ROA), bank-specific variables (CET1R, NPL_GL, Cost_IncR, NIM, NL_TCD, NonIntInc_TI), and country-specific variables (GDP, Inflation) undergo winsorization at the 1st percentile of each tail. For detailed variable definitions, refer to Table 1.

	Mean	STD	Min	Q1	Median	Q3	Max
Dependent Variable:							
Z_Score	7.5252	6.5483	0.2141	3.3616	5.9828	8.7655	37.5361
ROA	1.21%	0.44%	0.02%	0.96%	1.22%	1.46%	2.46%
Explanatory Variables:							
ESG_Score	34.74%	12.98%	5.84%	26.68%	33.42%	40.36%	84.48%
ENV_Score	5.26%	14.14%	0.00%	0.00%	0.00%	1.77%	90.02%
SOC_Score	32.69%	15.22%	1.02%	22.28%	30.38%	40.07%	91.74%
GOV_Score	49.36%	18.34%	3.59%	36.45%	50.21%	63.26%	92.17%
Bank-Specific Variables:							
CET1R	15.40%	4.08%	8.53%	12.65%	14.80%	17.11%	31.71%
NPL_GL	0.98%	0.79%	0.04%	0.45%	0.77%	1.29%	4.09%
Cost_IncR	65.27%	13.27%	0.22%	60.79%	66.75%	72.75%	89.63%
NIM	3.47%	0.63%	2.09%	3.13%	3.43%	3.75%	6.72%
NL_TCD	85.47%	16.75%	32.51%	75.36%	87.30%	95.58%	131.53%
NonIntInc_TI	26.75%	19.24%	1.86%	13.31%	22.92%	33.89%	113.83%
Country-Specific Variables:							
GDP	4.26%	4.10%	-3.70%	2.21%	3.83%	6.19%	14.63%
Inflation	2.94%	2.05%	1.40%	1.90%	2.10%	2.30%	7.00%

This pattern is particularly evident for the ESG explanatory variables. The average ESG score for the analyzed banks stands at 34.74%, with a minimum value of 5.84%, a median of 33.42%, and a maximum value of 84.48%. Furthermore, the descriptive analysis reveals that governance disclosure has the highest mean value (49.36%), followed by social disclosure (32.69%), whereas environmental disclosure exhibits the lowest mean value (5.26%) among the banks. These findings align with previous studies by Buallay (2019) and El Khoury, Nasrallah, and Alareeni (2021), affirming Buallay's conclusion that many banks prioritize the disclosure of corporate governance practices and roles in their reports, enhancing performance, while giving almost no attention to environmental disclosure, with a significant number of banks reporting zero environmental disclosure.

Regarding the dependent variables, the wide range and high standard deviation (6.55) in the z-score indicate substantial variation in financial stability and risk levels among the banks in the dataset. This suggests that while some banks exhibit high stability and low risk, others are significantly riskier. The minimum ROA of 0.02 indicates that some banks experienced very low profitability, potentially reflecting operational challenges, inefficiencies, or a highly competitive environment with thin margins.

For the bank-specific variables, banks exhibit a strong capital base (CET1R) with a mean of 15.40% and a relatively low standard deviation of 4.08%, suggesting that well-capitalized banks might experience lower riskiness (higher z-score) and potentially higher profitability (ROA). The stability in interest rate spreads, indicated by NIM values tightly clustered around the mean (3.47%) with low variability (standard deviation of 0.63%), suggests that financial institutions, on average, earn more interest income from interest-earning assets than they pay out in interest on interest-bearing liabilities. Similarly, the positive mean Net Loans to Total Customer Deposits (NL_TCD) ratio indicates that, on average, financial institutions have more loans outstanding to customers than they hold in customer deposits, signifying active lending activities.

Additionally, the mean ratio of Non-Interest Income to Total Income (NonIntInc_TI) at 26.75% suggests that diversification of income sources is common and could positively influence both riskiness and profitability by reducing reliance on traditional interest income. However, an overly cautious approach might hinder growth opportunities, while poor risk management could lead to higher credit risks, as indicated by the positive average Non-Performing Loans to Gross Loans (NPL_GL) ratio.

Conversely, higher cost-to-income ratios (65.27%) with significant variation (standard deviation of 13.27%) can indicate inefficiencies that negatively impact profitability, as higher operational costs reduce net income margins.

Country-specific variables also show significant economic variability. GDP growth values range from -3.70% to 14.63%, and inflation values range from 1.40% to 7.00%, reflecting diverse economic conditions and inflationary environments over the study period. This variability in GDP growth and inflation rates could significantly impact banks' performance, as high GDP growth rates might enhance profitability while varying inflation rates require careful management.

Table 3: Correlation Matrix

This table presents the pairwise correlations among the variables investigated in the study. The dataset comprises 1055 bank-year observations spanning the period from 2017 to 2021. Notably, dependent variables (Z_Score, ROA), bank-specific variables (CET1R, NPL_GL, Cost_IncR, NIM, NL_TCD, NonIntInc_TI), and country-specific variables (GDP, Inflation) undergo winsorization at the 1st percentile of each tail. For detailed variable definitions, refer to Table 1.

	Z_Score	ROA	ESG_Score	ENV_Score	SOC_Score	GOV_Score	CET1R	NPL_GL	Cost_IncR	NIM	NL_TCD	NonIntInc_TI	GDP	Inflation
Z_Score	1.0000													
ROA	N/A	1.0000												
ESG_Score	-0.0462	0.1586	1.0000											
ENV_Score	-0.1195	0.0879	N/A	1.0000										
SOC_Score	-0.0377	0.1759	N/A	N/A	1.0000									
GOV_Score	-0.0109	0.0836	N/A	N/A	N/A	1.0000								
CET1R	-0.0078	0.0974	-0.0823	- 0.0703	- 0.0618	- 0.0694	1.0000							
NPL_GL	-0.1193	-0.0118	0.0595	0.1141	0.0603	0.0127	-0.0453	1.0000						
Cost_IncR	-0.0948	-0.3461	-0.1963	- 0.1754	- 0.1904	- 0.1141	-0.0689	0.1807	1.0000					
NIM	0.0121	0.2688	-0.1098	- 0.2030	- 0.0992	- 0.0398	-0.0064	0.2453	0.0885	1.0000				
NL_TCD	0.1204	0.1007	-0.0571	- 0.1653	- 0.0239	- 0.0341	-0.1385	0.0066	0.1322	0.2140	1.0000			
NonIntInc_TI	-0.1063	0.1316	0.2199	0.2631	0.2362	0.0811	0.0705	0.1172	-0.0160	-0.1443	-0.3304	1.0000		
GDP	0.0052	0.1560	0.0772	0.0544	0.0843	0.0386	0.0130	-0.1052	-0.1746	-0.0679	-0.1827	-0.0019	1.0000	
Inflation	-0.0799	0.0989	0.1384	0.1272	0.1373	0.0760	0.0011	-0.0490	-0.2500	-0.2251	-0.2908	0.0636	0.8049	1.0000

4.2 Correlation Matrix

Table 3 presents the Pearson correlation matrix for the dependent and independent variables in the sample. The correlation analysis reveals that ESG scores and their components (Environmental (ENV), Social (SOC), and Governance (GOV) pillars) are negatively correlated with the z-score. This slight negative correlation suggests that higher ESG scores are associated with a marginal increase in riskiness, as indicated by a decrease in the z-score. Among the ESG components, the environmental score exhibits the most notable negative correlation with the z-score (-0.1195), indicating that environmental factors might contribute more to riskiness compared to social and governance factors.

Conversely, ESG scores and their pillars are positively correlated with banks' profitability (ROA), implying that higher ESG scores are associated with higher profitability. The social score has the strongest positive relationship with profitability (0.1759), followed by the overall ESG score, governance score, and environmental score.

The correlation matrix reveals that ESG-related parameters generally exhibit weak relationships with the bank-specific variables of U.S. banks, suggesting that these ESG-related parameters have a limited direct impact on the primary financial indicators during the study period from 2017 to 2021.

In contrast, notable relationships exist between bank-specific variables and the profitability and riskiness of U.S. banks. Specifically, the cost-to-income ratio (Cost_IncR) shows a strong negative correlation with ROA (-0.4030), indicating that higher costs relative to income significantly reduce profitability. Net Interest Margin (NIM) and Net Loans to Total Customer Deposits (NL_TCD) are positively correlated with ROA (0.2688 and 0.1007, respectively), highlighting that higher ratios enhance profitability. Additionally, Non-Performing Loans to Gross Loans (NPL_GL) and Non-Interest Income to Total Income (NonIntInc_TI) exhibit negative correlations with the z-score (-0.1268 and -0.1063, respectively), positively affecting bank riskiness.

Following the rule of thumb, correlation coefficients between -0.8 and +0.8 indicate no multicollinearity problems. Except for the country-specific variables, GDP growth and inflation, all other pairwise correlations fall below this threshold, ruling out multicollinearity issues. However, the strong correlation between GDP growth and inflation (0.8049) could be problematic in a regression model. The multicollinearity test, indicated by a VIF around 9, confirms this issue. Nevertheless, it was decided not to exclude either of these two variables from the analysis.

4.3 Regression Results and Discussion

As established earlier, the Hausman test results in Appendix 2 confirm the suitability of the Random-Effects (RE) panel model for subsequent analysis. Therefore, the following discussion employs the RE panel regression approach, utilizing 1055 bank-year observations. Across all panel models, the coefficients are presented without adjusting for entity/bank or time effects.

Table 4 and Table 6 provide a comprehensive overview of the RE panel regression models, focusing on forecasting the influence of ESG disclosure scores on the riskiness and profitability of U.S. banks, measured by the z-score and ROA respectively. This analysis entails eight models, integrating both bank-specific and country-specific variables.

To ensure robustness and sensitivity, eight models are considered—four for each hypothesis. Each model concentrates on one of the ESG scores: Model A and Model E account for the overall ESG score, Model B and Model F for the environmental score, Model C and Model G for the social score, and Model D and Model H for the governance score. Separate models were used for each ESG component to avoid multicollinearity issues.

Commencing with Table 4, the R-squared (R^2) values for models A through D range from approximately 6.76% to 7.38%, indicating they explain about 7% of the variability in the z-score. Among the models, Model B, has the highest R^2, indicating that it explains slightly more variance in the riskiness than the other models. This might be due to the inclusion of the environmental score, which has a strong and significant impact on the bank's riskiness. While statistically significant, this relatively low R^2 suggests other unobserved factors significantly impact bank riskiness, underscoring the complexity of the banking sector.

Even though R^2 is an important indicator of model quality, it is not the sole. In the context of financial and economic data, R^2 values can often be lower due to the inherent complexity and variability of the data. This suggests that while ESG factors, bank-specific variables, and country-specific variables are important, many other unobserved factors also play a significant role in determining the riskiness of banks.

Exploring the relationship between ESG determinants, bank-specific, and country-specific variables, and the z-score of U.S. banks, findings are inconsistent. ESG determinants exhibit a statistically significant negative relationship with the z-score, suggesting higher risk associated with stronger ESG scores. However, the significance and magnitude of ESG determinants vary across models, indicating a less consistent relationship. Specifically, the most significant ESG determinant is the environmental (-5.24) at a 1% interval confidence level, indicating that environmental performance is associated with higher riskiness. It is followed by the social determinant (-2.94) at a 5% interval confidence level and then the collective ESG score (-3.19) at a 10% confidence level. Governance score (-0.18) it seems that is not statistically significant at any interval confidence level.

These results support the first hypothesis (H1) that ESG parameters positively affect bank riskiness, contrasting with findings from other studies (Di Tommaso and Thornton,2020 and Chiaramonte et al., 2021). Both Di Tommaso and Thornton (2020); Chiaramonte et al. (2021) agree that higher ESG scores are associated with reduced risk and greater stability. This consensus extends to Bouslah et al. (2018), who also find a negative correlation between social performance and risk, particularly during crises.

On the other hand, the RE panel regression analysis indicates that cost efficiency, as measured by Cost-to-Income Ratio (Cost_IncR) and effective use of deposits, as indicated by Net Loans to Total Customer Deposits (NL_TCD) are significant determinants of bank riskiness. Banks that manage their operating costs well and maintain a higher proportion of loans relative to deposits tend to be less risky.

Despite the theoretical importance of the Common Equity Tier 1 Ratio (CET1R), Non-Performing Loans to Gross Loans (NPL_GL), and Net Interest Margin (NIM) in assessing bank risk, their insignificance in these models (A to D) suggests that within the context of this study, these variables do not have a measurable impact on the z-score. The p-values for these variables are all above 0.10, indicating no strong evidence of an impact on bank riskiness within this dataset and period, highlighting the need to consider a broad range of factors

Table 4: Random Effects Regression Models

This table presents the results of the Random Effects Regression Models exploring the relationship between Riskiness, as measured by z-score, and ESG determinants (ESG, ENV, SOC, GOV scores), bank-specific variables (CET1R, NPL_GL, Cost_IncR, NIM, NL_TCD, NonIntInc_TI), and country-specific variables (GDP, Inflation). The standard errors are robust to heteroskedasticity. The dataset comprises 1055 bank-year observations spanning the period from 2017 to 2021. Notably, dependent variables, bank-specific variables, and country-specific variables undergo winsorization at the 1st percentile of each tail. For detailed variable definitions, refer to Table 1. Significance levels (two-tailed) are denoted by ***, **, and *, indicating p-values < 0.01, < 0.05, and < 0.10, respectively.

	Model A		**Model B**		**Model C**		**Model D**	
	Coefficients	**p-value**	**Coefficients**	**p-value**	**Coefficients**	**p-value**	**Coefficients**	**p-value**
Dependent Variable: Z_Score								
ESG_Score	-3.1880	0.0833*						
ENV_Score			-5.2350	0.0000***				
SOC_Score					-2.9380	0.0460**		
GOV_Score							-0.1847	0.8908
CET1R	-10.164	0.1471	-10.922	0.1168	-10.138	0.1478	-9.6889	0.1634
NPL_GL	-26.773	0.2585	-19.511	0.4097	-29.120	0.2138	-28.200	0.2292
Cost_IncR	-5.9325	0.0003***	-6.1582	0.0002***	-5.8960	0.0004***	-5.6369	0.0006***
NIM	-26.061	0.5462	-35.754	0.4117	-26.194	0.5442	-22.466	0.6032
NL_TCD	7.0381	0.0020***	6.6663	0.0032***	7.1341	0.0017***	6.9612	0.0022***
NonIntInc_TI	0.9398	0.4146	1.1064	0.3389	1.0322	0.3656	0.6904	0.5430
GDP	30.014	0.0000***	30.004	0.0000***	30.101	0.0000***	31.068	0.0000***
Inflation	-66.674	0.0000***	-66.744	0.0000***	-66.436	0.0000***	-70.368	0.0000***
Constant	9.6505	0.0011***	9.6241	0.0009***	9.3855	0.0013***	8.4524	0.0033***
Observations	1055		1055		1055		1055	
Model	Random		Random		Random		Random	
Bank fixed effect	No		No		No		No	
Time fixed effect	No		No		No		No	
R^2	0.0697		0.0738		0.0703		0.0676	

Table 6: Random Effects Regression Models

This table presents the results of the Random Effects Regression Models exploring the relationship between Profitability, as measured by ROA, and ESG determinants (ESG, ENV, SOC, GOV scores), bank-specific variables (CET1R, NPL_GL, Cost_IncR, NIM, NL_TCD, NonIntInc_TI), and country-specific variables (GDP, Inflation). The standard errors are robust to heteroskedasticity. The dataset comprises 1055 bank-year observations spanning the period from 2017 to 2021. Notably, dependent variables, bank-specific variables, and country-specific variables undergo winsorization at the 1st percentile of each tail. For detailed variable definitions, refer to Table 1. Significance levels (two-tailed) are denoted by ***, **, and *, indicating p-values < 0.01, < 0.05, and < 0.10, respectively.

	Model E		Model F		Model G		Model H	
	Coefficients	**p-value**	**Coefficients**	**p-value**	**Coefficients**	**p-value**	**Coefficients**	**p-value**
Dependent Variable: ROA								
ESG_Score	0.0037	0.0041***						
ENV_Score			0.0024	0.0239**				
SOC_Score					0.0028	0.0109***		
GOV_Score							0.0015	0.0557*
CET1R	0.0142	0.0004***	0.0141	0.0005***	0.0139	0.0055***	0.0138	0.0006***
NPL_GL	-0.0218	0.2021	-0.0240	0.1686	-0.0198	0.2484	-0.0205	0.2327
Cost_IncR	-0.0103	0.0000***	-0.0105	0.0000***	-0.104	0.0000***	-0.0106	0.0000***
NIM	0.2295	0.0000***	0.2321	0.0000***	0.2285	0.0000***	0.2255	0.0000***
NL_TCD	0.0048	0.0000***	0.0050	0.0000***	0.0047	0.0001***	0.0049	0.0000***
NonIntInc_TI	0.0039	0.0001***	0.0040	0.0000***	0.0039	0.0001***	0.0042	0.0000***
GDP	0.0180	0.000***	0.0173	0.0001***	0.0177	0.0000***	0.0175	0.0001***
Inflation	-0.0031	0.7700	-0.0004	0.9656	-0.0026	0.8075	-0.0007	0.9489
Constant	0.0017	0.3965	0.0027	0.9058	0.0023	0.2481	0.0024	0.2402
Observations	1055		1055		1055		1055	
Model	Random		Random		Random		Random	
Bank fixed effect	No		No		No		No	
Time fixed effect	No		No		No		No	
R^2	0.2441		0.2403		0.2431		0.2395	

when assessing bank stability. This could happen due to the specific characteristics of the dataset, time period, or the presence of other more dominant factors influencing bank riskiness.

Lastly, the regression analysis demonstrates that macroeconomic conditions significantly influence bank riskiness. Specifically, a higher GDP growth rate enhances bank stability, as indicated by increased z-scores. Higher GDP growth typically leads to better economic conditions, increased business activities, and improved financial health of borrowers, which collectively reduce the default risk and enhance the overall stability of banks, while higher inflation undermines it, leading to decreased z-scores. Higher inflation erodes the real value of financial assets, increases uncertainty in the economy, and can lead to higher interest rates, which may elevate the cost of borrowing and the risk of loan defaults. These findings underscore the importance of stable and favorable economic conditions for maintaining a robust banking sector. Policymakers and bank management should closely monitor these macroeconomic indicators to mitigate risks and enhance the stability of banks.

Table 5 highlights the most important findings derived from the RE panel regression models in Table 4.

Table 5: Random Effects Regression Important Results

Dependent Variable: z-score

- $R^2 \approx 7\%$ → The models explain a small portion of the variance in bank riskiness (z-score).
- **ESG Explanatory Variables:**

  → ESG Score = -3.19 (*)
  → ENV Score = -5.24 (***)
  → SOC Score = -2.94 (**)

  Negatively effect on z-score → Indicating increased bank riskiness.

  Acceptance of H1: ESG parameters positively affect the riskiness of a U.S. bank.
- **Bank-Specific Variables (CAMELS):**

  → Cost to Income Ratio ≈ -6 (***)
  → Net Loans to Total Customer Deposits ≈ 7 (***)
- **Country-Specific Variables:**

  → GDP growth ≈ 30 (***)
  → Inflation ≈ -67 (***)

The subsequent analysis presents the results of the RE panel regression models, as displayed in Table 6, investigating the intricate relationship between ESG determinants, bank-specific variables, country-specific variables, and the return on assets (ROA) of U.S. banks. These findings delve deeper into the drivers of bank profitability compared to the previous examination focused on riskiness.

The R^2 values for models E through H indicate that approximately 24% of the variation in ROA can be elucidated by the included independent variables. This suggests that the models capture about a quarter of the factors influencing bank profitability, as measured by ROA. Specifically, the R^2 values range from 23.95% to 24.41%, signifying that the inclusion of different ESG components does not markedly alter the overall explanatory power of the models.

Such R^2 values are typical in empirical finance studies, underscoring the significance of ESG determinants and bank-specific variables in shaping profitability. However, it's important to acknowledge that other unobserved factors also wield substantial influence. This underscores the complexity of bank profitability and underscores the necessity of considering a broader spectrum of influences beyond those captured by the included variables.

From the provided table, several conclusions can be drawn regarding the ESG determinants (overall ESG score and ENV, SOC, and GOV scores) in relation to profitability. The coefficients of the overall ESG score and the individual ESG scores are all positive and statistically significant, underscoring the pivotal role of sustainable practices in augmenting financial performance. These results buttress the second hypothesis (H2) positing that ESG parameters positively impact the profitability of U.S. banks.

This finding aligns with previous research by Birindelli et al. (2018) and Buallay (2019), which indicates that more profitable banks tend to have better ESG performance. Buallay (2019) also reveals that environmental disclosure positively impacts performance, while CSR and governance disclosures have mixed or negative effects. However, other studies such as Di Tommaso and Thornton (2020) report a negative impact of ESG on bank value, attributing it to overinvestment, while El Khoury et al. (2021) suggest that banks may enhance social disclosures to mask poor financial performance.

In this study, the overall ESG score, and social score are significant at the 1% confidence level, followed by the environmental score at 5%, indicating that banks excelling in environmental and social aspects tend to exhibit higher profitability. Governance, while statistically significant, shows a less pronounced influence on profitability compared to environmental and social factors. The consistency of positive coefficients across all ESG pillars (models E to H) reinforces the conclusion that ESG performance, particularly in environmental and social dimensions, positively influences bank profitability.

In addition to the ESG determinants, the analysis identifies several bank-specific variables as significant predictors of bank profitability. Higher capital ratios (CET1R), better net interest margins (NIM), efficient loan-to-deposit ratios (NL_TCD), and diversified income sources (NonIntInc_TI) are all associated with greater profitability. Conversely, higher cost-to-income ratios (Cost_IncR) negatively impact profitability, indicating that lower operational efficiency hampers financial performance.

While non-performing loans (NPL_GL) exhibit a negative relationship with profitability, the results are not statistically significant, suggesting that credit risk, as measured by non-performing loans to gross loans, does not conclusively affect profitability in this analysis.

Overall, the findings from the RE regression models underscore the multifaceted determinants of bank profitability in the U.S. Sustainable practices, efficient cost management, favorable interest margins, robust loan-to-deposit ratios, and diversified income sources all play crucial roles in enhancing bank profitability. These insights offer valuable implications for bank management, policymakers, and investors in comprehending the factors driving bank profitability and formulating strategies to bolster financial performance and sustainability in the banking sector.

Continuing, the analysis delves into the relationship between country-specific variables and bank profitability. Higher GDP growth significantly correlates with bank profitability, indicating improved bank performance in stronger economic environments. Conversely, inflation does not demonstrate a significant relationship with profitability in this dataset, suggesting that its impact may be more intricate or context-dependent and not directly observable in this study.

Based on the results, the concerns of investors that ESG investments might lead to resource misallocation and reduced profitability are not confirmed. Instead, the findings suggest the opposite: higher ESG performance, particularly in environmental and social aspects, is associated with increased profitability for U.S. banks. This demonstrates that ESG investments can positively contribute to financial performance, contradicting the notion that they detract from profitability.

Furthermore, while certain ESG determinants are associated with higher risk, as indicated by a negative relationship with the z-score, this does not necessarily result in lower profitability. The inconsistency in the significance of ESG determinants suggests that their varying impacts on risk do not undermine their overall positive contribution to profitability, especially concerning environmental and social factors. Therefore, the study supports the notion that ESG integration aligns with financial performance, indicating that ESG investments do not inherently lead to resource misallocation or reduced profitability. Instead, they may offer a strategic advantage by enhancing both sustainability and profitability in the banking sector.

Table 7 encapsulates the most significant findings derived from the RE panel regression model in Table 6.

Table 7: Random Effects Regression Important Results

Dependent Variable: ROA

- R^2 ≈ 24% → The models explain about 24% of the variability in bank profitability (ROA).
- **ESG Explanatory Variables:**

  → ESG Score = 0.0037 (***)
  → ENV Score = 0.0024 (**)
  → SOC Score = 0.0028 (***)
  → GOV Score = 0.0015 (*)

  (All four:) Positively effect on ROA → Indicating increased bank profitability.

  Acceptance of H2: ESG parameters positively affect the profitability of a U.S. bank.

- **Bank-Specific Variables (CAMELS):**

  → CET1 Ratio,
  → Net Interest Margin,
  → Net Loans to Total Customer Deposits &
  → Non-interest income to Total Income (All ***)

  (All four:) Banks tend to be more profitable.

  → Cost to Income Ratio (***) → Banks tend to be less profitable.

- **Country-Specific Variables:**

  → GDP growth ≈ 0.0177 (***)

5. Additional Analyses and Robustness Checks

To ensure the robustness and sensitivity of the analysis, we implemented eight distinct econometric models, with four models dedicated to each of the two hypotheses under investigation. Each model isolates one of the Environmental, Social, and Governance (ESG) scores alongside the overall ESG score, thus addressing the potential issue of multicollinearity that could arise from including all four ESG factors simultaneously. This disaggregated approach enables a more granular examination of the individual impact of each ESG component on the dependent variables. The uniform structure of the models across both hypotheses ensures comparability and facilitates a detailed analysis of how each ESG component behaves under various conditions.

To further validate our findings, we conducted a series of five critical diagnostic tests: the Normality Test, Autocorrelation Test, Heteroscedasticity Test, Collinearity Test, and Stationarity Test. Additionally, outliers were managed through winsorization at the 1st and 99th percentiles, ensuring that extreme values did not unduly influence the results. Our econometric models incorporated both bank-specific variables, based on the CAMELS framework, and country-specific macroeconomic variables, such as GDP growth rate and inflation. The selection between fixed or random-effects models was guided by the Hausman test results, ensuring the most appropriate specification for our panel data analysis.

To enhance the robustness of our findings, additional robustness checks were performed, including the logarithmic transformation of the z-score. These supplementary analyses help confirm the stability and reliability of our results under different model specifications and transformations. The outcomes of these robustness checks, alongside the primary results, are presented in the subsequent sections.

Table 8: Descriptive Statistics

This table presents descriptive statistics, including mean, median, standard deviation, minimum and maximum values, as well as the 1st and 3rd quartiles (Q1 & Q3), for all variables examined in the study. The dataset comprises 1055 bank-year observations spanning the period from 2017 to 2021. Notably, dependent variables (ln (Z_Score), ROA), bank-specific variables (CET1R, NPL_GL, Cost_IncR, NIM, NL_TCD, NonIntInc_TI), and country-specific variables (GDP, Inflation) undergo winsorization at the 1st percentile of each tail. For detailed variable definitions, refer to Table 1.

	Mean	STD	Min	Q1	Median	Q3	Max
Dependent Variable:							
ln (Z_Score)	1.6963	0.9074	-1.4706	1.2366	1.7965	2.1752	3.7739

Firstly, we conducted descriptive statistics with the logarithmic transformation of the z-score. All other variables retained the same results for measures of mean, median, standard deviation, minimum and maximum values, and the first and third quartiles. Consequently, Table 8 presents only the descriptive statistics for ln(z-score), underscoring the advantages of the logarithmic transformation in enhancing robustness checks.

The first observation from Table 8 reveals that while the mean of the raw z-score is 7.53, the mean of ln(z-score) is 1.70. The logarithmic transformation centers the data more compactly around the mean, which is beneficial for normalizing skewed distributions. Furthermore, the ln(z-score) exhibits a lower standard deviation of 0.91 compared to the raw z-score's 6.55, indicating reduced variability and improved data stability. Additionally, the logarithmic transformation significantly compresses the range of values (-1.47 to 3.77), effectively mitigating the impact of outliers more than the raw z-score (0.21 to 37.54).

In summary, transforming the z-score into its natural logarithm, ln(z-score), effectively normalizes the data, reduces variability, and diminishes the influence of outliers. This provides a more stable and consistent measure of bank riskiness for robust statistical analysis, ensuring more reliable and interpretable results in the robustness check of the study.

Table 9: Random Effects Regression Models

This table presents the results of the Random Effects Regression Models exploring the relationship between Riskiness, as measured by ln(z-score), and ESG determinants (ESG, ENV, SOC, GOV scores), bank-specific variables (CET1R, NPL_GL, Cost_IncR, NIM, NL_TCD, NonIntInc_TI), and country-specific variables (GDP, Inflation). The standard errors are robust to heteroskedasticity. The dataset comprises 1055 bank-year observations spanning the period from 2017 to 2021. Notably, dependent variables, bank-specific variables, and country-specific variables undergo winsorization at the 1st percentile of each tail. For detailed variable definitions, refer to Table 1. Significance levels (two-tailed) are denoted by ***, **, and *, indicating p-values < 0.01, < 0.05, and < 0.10, respectively.

	Model I		Model J		Model K		Model L	
	Coefficients	**p-value**	**Coefficients**	**p-value**	**Coefficients**	**p-value**	**Coefficients**	**p-value**
Dependent Variable: ln (Z_Score)								
ESG_Score	-0.1625	0.5838						
ENV_Score			-0.3991	0.0544**				
SOC_Score					-0.2667	0.2720		
GOV_Score							0.1071	0.5615
CET1R	0.1734	0.8545	0.1000	0.9153	0.1563	0.8689	0.2109	0.8221
NPL_GL	-0.1482	0.9691	0.4555	0.9062	-0.2944	0.9385	-0.3441	0.9281
Cost_IncR	-1.0432	0.0001***	-1.0685	0.0000***	-1.0526	0.0000***	-1.0160	0.0001***
NIM	2.2993	0.6702	1.4527	0.7893	2.1445	0.6907	2.5304	0.6414
NL_TCD	0.9219	0.0019***	0.8965	0.0025***	0.9337	0.0018***	0.9172	0.0019***
NonIntInc_TI	0.0371	0.8270	0.0571	0.7368	0.0557	0.7458	0.0213	0.8986
GDP	3.1143	0.0007***	3.0851	0.0007***	3.0774	0.0007***	3.2149	0.0005***
Inflation	-6.5055	0.0045***	-6.4115	0.0041***	-6.3285	0.0054***	-6.8273	0.0025***
Constant	1.5898	0.004***	1.6206	0.0002***	1.6174	0.0002***	1.4642	0.0010***
Observations	1055		1055		1055		1055	
Model	Random		Random		Random		Random	
Bank fixed effect	No		No		No		No	
Time fixed effect	No		No		No		No	
R^2	0.0544		0.0560		0.0552		0.0544	

Continuing to the robustness checks with the logarithmic transformation of the z-score, Table 9 presents the results of the RE panel regression models exploring the relationship between riskiness, as measured by ln(z-score), instead of raw z-score, and ESG determinants, bank-specific and country-specific variables.

The R^2 values for all four models (Model I to Model L) are relatively low, ranging from 5.44% to 5.60%. This indicates that the models explain only about 5.50% of the variance in ln(z-score). Despite the low R^2, the models still provide valuable insights into the relationships between the included variables and the logarithmic transformation of the z-score.

The analysis of ESG determinants reveals that only the environmental score has a significant relationship with ln(z-score). Specifically, Model B shows that the environmental score has a negative coefficient of -0.40 with a p-value of 0.05, indicating a weak but statistically significant negative relationship. This suggests that higher environmental scores are associated with higher bank riskiness. The other ESG determinants, including the overall (ESG score, SOC score, and GOV score), are not statistically significant, suggesting that these factors may not be as influential in determining bank riskiness.

Among the bank-specific variables, the cost-to-income ratio (Cost_IncR) and net loans to total customer deposits (NL_TCD) are consistently significant across all models. Cost_IncR has a strong negative relationship with ln(z-score), indicating that higher cost efficiency is associated with increased bank riskiness. On the other hand, NL_TCD has a positive and significant relationship with ln(z-score), suggesting that higher loan intensity is linked to lower bank risk. The other bank-specific variables (CET1R, NPL_GL, NIM, and NonIntInc_TI) are not statistically significant, indicating a limited impact on bank riskiness in these models.

The country-specific variables, GDP growth rate, and inflation demonstrate strong and significant relationships with ln(z-score) across all models. The GDP growth rate has a positive coefficient of approximately 3.10, which means that as the economy grows, the risk of bank insolvency decreases. Inflation, on the other hand, has a consistently negative and significant coefficient of around -6.50%, suggesting that the higher the inflation, the higher the bank risk.

In conclusion, the utilization of ln(z-score) yields superior results compared to the raw z-score, primarily attributed to heightened data stability and diminished variability. The ln(z-score) models furnish more consistent and reliable estimates, thereby bolstering the robustness of our statistical analyses. This transformation proves pivotal in ensuring a stable assessment of bank riskiness, which is indispensable for interpreting the intricate dynamics of Environmental, Social, and Governance (ESG) components and other pertinent variables within our econometric frameworks.

Table 10 summarizes key findings extracted from the RE panel regression model delineated in Table 9.

Table 10: Random Effects Regression Important Results

Dependent Variable: ln(z-score)

- R^2 ≈ 5.60% → The models explain a small portion of the variance in bank riskiness (ln(z-score)).
- **ESG Explanatory Variables:**

  → ENV Score = -0.40 (**) → Negatively effect on ln(z-score) → Indicating increased bank riskiness.

  Acceptance of H1: ESG parameters positively affect the riskiness of a U.S. bank.
- **Bank-Specific Variables (CAMELS):**

  → Cost to Income Ratio ≈ -1.05 (***)
  → Net Loans to Total Customer Deposits ≈ 0.92 (***)
- **Country-Specific Variables:**

  → GDP growth ≈ 3.10 (***)
  → Inflation ≈ -6.50 (***)

6. Conclusions

6.1 Summary

This study examines the relationship between Environmental, Social, and Governance (ESG) determinants and the riskiness of U.S. banks, focusing on models A to D. The analysis reveals a statistically significant negative association between ESG determinants and the z-score, indicating higher risk, thus supporting the first hypothesis. However, the significance of ESG determinants varies, suggesting an inconsistent relationship with bank riskiness. Notably, environmental factors demonstrate the most significant impact, followed by social factors, while governance factors lack statistical significance. Significant associations are also observed between certain bank-specific variables and the z-score, particularly the cost-to-income ratio and net loans to total customer deposits, which are negatively and positively related to bank riskiness, respectively. Other bank-specific variables show no statistical significance, indicating the need for alternative measures.

In models E to H, a higher ESG performance, particularly in environmental and social aspects, appears linked to increased profitability for U.S. banks, as measured by Return on Assets (ROA). These findings highlight the relevance of ESG considerations in assessing financial performance and sustainability in banking, leading to the acceptance of the second hypothesis. Furthermore, the RE panel regression models underscore the multifaceted determinants of bank profitability, including sustainable practices, efficient cost management, favorable interest margins, robust loan-to-deposit ratios, and diversified income sources.

Considering the transformation from raw z-score to ln(z-score) models (models I to L), the latter demonstrates enhanced data stability and reduced variability. While the raw z-score models exhibit slightly higher explanatory power, ln(z-score) models provide more consistent and reliable estimates, crucial for robust statistical analysis. This transformation ensures a stable measure of bank riskiness, facilitating the interpretation of ESG components and other variables in econometric models. However, the acceptance of the first hypothesis remains, as ESG parameters positively affect the riskiness of U.S. banks.

Moreover, robust macroeconomic indicators such as GDP growth and inflation significantly influence bank stability, emphasizing the importance of the broader economic environment.

These insights offer valuable guidance for corporate boards, stakeholders, and policymakers in the banking sector to promote ESG initiatives and integrate ESG considerations into decision-making processes. By contributing to the understanding of sustainability practices, this research encourages further exploration of the linkages between ESG factors, profitability, and risk within financial institutions by academics and analysts. Additionally, investors can leverage these findings to make informed decisions regarding the impact of ESG practices on financial performance, thereby contributing to societal welfare by recognizing the significant influence of ESG factors on economic and social dimensions.

Overall, this research bridges the gap between sustainable practices and financial performance, providing practical implications for enhancing risk management strategies, aligning banking practices with stakeholder expectations, and evaluating the impact of ESG initiatives on competitive positioning. These insights underscore the potential of ESG integration to drive positive change in the banking sector, contributing to both financial performance and broader stakeholder value.

Additionally, the study's findings support the notion that ESG integration can be aligned with financial performance, suggesting that ESG investments do not inherently lead to resource misallocation or reduced profitability. Instead, they may offer a strategic advantage by enhancing sustainability and profitability in the banking sector.

6.2 Limitations and Recommendations

This study has several limitations that need to be acknowledged. Firstly, the analysis is based on a relatively small sample of 211 banks in the USA, covering a limited period from 2017 to 2021. This narrow scope may limit the generalizability of the findings to broader contexts or different time periods. A larger and more diverse sample, encompassing banks from various regions and an extended timeframe, would provide more robust and widely applicable insights.

Additionally, the study does not account for potential variations in the impact of ESG activities on bank risk and profitability during periods of financial crisis. Given the significant banking reforms implemented in response to such events, it would be valuable to explore whether these reforms have altered the dynamics between ESG activities and financial performance. Future research should consider examining these relationships across different economic conditions, particularly during times of financial instability. This could involve avoiding periods of economic crises or making necessary adjustments to account for such anomalies, leading to more consistent findings. Including interaction variables could further refine the analysis by capturing more complex relationships between ESG activities and financial performance.

The validation tests performed on the models revealed a significant multicollinearity issue between two of the six CAMELS variables: Net Interest Margin (NIM) and Net Loans to Total Customer Deposits (NL_TCD). While a threshold of 15 was used to detect multicollinearity in this study, which is higher than the commonly used thresholds of 5 or 10, it was decided not to exclude any CAMELS variables due to their importance as financial indicators. Future studies might consider substituting these variables with alternative measures that do not suffer from multicollinearity, thereby enhancing the robustness of the models. Further research could explore the use of alternative CAMELS variables or other financial metrics that may better satisfy these assumptions, thereby improving the validity of the findings.

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Appendices

Appendix 1: Model Validation

Model Validation

This table evaluates the validity of the models through a series of tests, including Normality, Collinearity, Stationarity, Autocorrelation, and Heteroscedasticity. These tests are conducted to ensure the reliability and robustness of the statistical model employed in the study. The dataset comprises 1055 bank-year observations spanning the period from 2017 to 2021. Notably, dependent variables (Z_Score, ROA), bank-specific variables (CET1R, NPL_GL, Cost_IncR, NIM, NL_TCD, NonIntInc_TI) and country-specific variables (GDP, Inflation) undergo winsorization at the 1st percentile of each tail. For detailed variable definitions, refer to Table 1. Significance levels (two-tailed) are denoted by ***, **, and *, indicating p-values < 0.01, < 0.05, and < 0.10, respectively.

Normality Test: Shapiro-Wilk / Kolmogorov-Smirnov								
	Model A	**Model B**	**Model C**	**Model D**	**Model E**	**Model F**	**Model G**	**Model H**
Dependent variables:								
Z_Score	0.0000***	0.0000***	0.0000***	0.0000***				
ROA					0.0000***	0.0000***	0.0000***	0.0000***
Explanatory Variables:								
ESG_Score	0.0000***				0.0000***			
ENV_Score		0.0000***				0.0000***		
SOC_Score			0.0000***				0.0000***	
GOV_Score				0.0000***				0.0000***
Bank-Specific Variables (CAMELS):								
CET1R	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
NPL_GL	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Cost_IncR	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
NIM	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
NL_TCD	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
NonIntInc_TI	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Country-Specific Variables:								

GDP	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Inflation	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***

Stationarity Test: ADF / Phillips-Perron								
	Model A	**Model B**	**Model C**	**Model D**	**Model E**	**Model F**	**Model G**	**Model H**
Dependent variables:								
Z_Score	-7.0281***	-7.0281***	-7.0281***	-7.0281***				
ROA					-7.5928***	-7.5928***	-7.5928***	-7.5928***
Explanatory Variables:								
ESG_Score	-7.5414***				-7.5414***			
ENV_Score		-6.3742***				-6.3742***		
SOC_Score			-8.2867***				-8.2867***	
GOV_Score				-15.2317***				-15.2317***
Bank-Specific Variables (CAMELS):								
CET1R	-10.2458***	-10.2458***	-10.2458***	-10.2458***	-10.2458***	-10.2458***	-10.2458***	-10.2458***
NPL_GL	-9.1500***	-9.1500***	-9.1500***	-9.1500***	-9.1500***	-9.1500***	-9.1500***	-9.1500***
Cost_IncR	-6.3567***	-6.3567***	-6.3567***	-6.3567***	-6.3567***	-6.3567***	-6.3567***	-6.3567***
NIM	-6.0124***	-6.0124***	-6.0124***	-6.0124***	-6.0124***	-6.0124***	-6.0124***	-6.0124***
NL_TCD	-7.8396***	-7.8396***	-7.8396***	-7.8396***	-7.8396***	-7.8396***	-7.8396***	-7.8396***
NonIntInc_TI	-8.3525***	-8.3525***	-8.3525***	-8.3525***	-8.3525***	-8.3525***	-8.3525***	-8.3525***
Country-Specific Variables:								
GDP	-7.2153***	-7.2153***	-7.2153***	-7.2153***	-7.2153***	-7.2153***	-7.2153***	-7.2153***
Inflation	- 696010093837 3475.0***	- 696010093837 3475.0***	- 696010093837 3475.0***	- 696010093837 3475.0***	- 696010093837 3475.0***	- 696010093837 3475.0***	- 696010093837 3475.0***	- 69601009383 73475.0***

Collinearity Test: VIF test								
	Model A	**Model B**	**Model C**	**Model D**	**Model E**	**Model F**	**Model G**	**Model H**
Explanatory Variables:								
ESG_Score	8.3222				8.4591			
ENV_Score		1.2931				1.3014		
SOC_Score			6.0464				6.1433	
GOV_Score				7.8187				7.8571
Bank-Specific Variables (CAMELS):								
CET1R	12.9824	12.9649	12.9727	12.9912	13.2219	13.2263	13.2179	13.2340
NPL_GL	2.9308	2.9759	2.9334	2.9259	2.9137	2.9662	2.9168	2.9073
Cost_IncR	21.7903	21.9371	21.9167	21.7873	25.1277	25.1810	25.1571	25.2337
NIM	29.1187	29.0164	28.9374	29.4576	34.4228	34.8244	34.3721	34.7398
NL_TCD	27.0783	25.5493	27.1366	26.1555	28.1443	26.8761	28.1872	27.5047
NonIntInc_TI	3.3769	3.3119	3.3990	3.1485	3.5961	3.5510	3.6172	3.4130
Country-Specific Variables:								
GDP	6.2354	6.2121	6.2178	6.2411	6.2441	6.2182	6.2238	6.2448
Inflation	8.9327	8.6729	8.8152	8.8434	8.8959	8.6573	8.7836	8.8098

Autocorrelation Test: Durbin Watson test								
	Model A	**Model B**	**Model C**	**Model D**	**Model E**	**Model F**	**Model G**	**Model H**
Dependent variables:								
Z_Score	0.4360	0.4360	0.4360	0.4360				
ROA					0.1551	0.1551	0.1551	0.1551

Heteroscedasticity Test: Breusch-Pagan test								
	Model A	**Model B**	**Model C**	**Model D**	**Model E**	**Model F**	**Model G**	**Model H**
Lagrange multiplier statistic	20.4530	22.8021	19.5798	20.6272	45.6419	44.6807	44.6990	42.8438
p-value	0.0153	0.0067	0.0207	0.0144	0.0000	0.0000	0.0000	0.0000
f-value	2.2955	2.5699	2.1957	2.3155	5.2504	5.1349	5.1371	4.9149
f p-value	0.0149	0.0064	0.0203	0.0140	0.0000	0.0000	0.0000	0.0000

Appendix 2: Hausman Test

Hausman Test Results

This table presents the result of the Hausman test for the models, evaluating the consistency of the estimated coefficients between the Fixed Effects (FE) and Random Effects (RE) models. The standard errors are robust to heteroskedasticity. The dataset comprises 1055 bank-year observations spanning the period from 2017 to 2021. Notably, dependent variables (Z_Score, ROA), bank-specific variables (CET1R, NPL_GL, Cost_IncR, NIM, NL_TCD, NonIntInc_TI), and country-specific variables (GDP, Inflation) undergo winsorization at the 1^{st} percentile of each tail. For detailed variable definitions, refer to Table 1. Significance levels (two-tailed) are denoted by ***, **, and *, indicating p-values < 0.01, < 0.05, and < 0.10, respectively.

	z-score				**ROA**			
	Model A	**Model B**	**Model C**	**Model D**	**Model E**	**Model F**	**Model G**	**Model H**
Hausman Test Statistic:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
p-value:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00